Understanding the integration of ecosystem services and natural capital in Scottish policy

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ABSTRACT

Despite the growing body of evidence highlighting how human activity both depends on and keeps deteriorating natural resources, traditional development models have failed to bring about conservation solutions to this contradiction. The twin concepts of ecosystem services and natural capital (ES/NC) have been coined to bridge this cognitive gap, by providing a framework to make the benefits that human societies derive from ecosystems more visible and intelligible for policy- and decision-making. As part as a global effort, European Union institutions have been promoting these notions over the last decade. The effective take-up of the ES/NC framework is therefore crucial to the success or failure of this attempted cognitive shift in influencing public decision outcomes. This article presents an assessment of the integration of ES/NC in Scottish policy, conceptually and operationally. Forestry is used as an exemplar policy sector to illustrate integration dynamics and limitations, but eight other policy areas were analysed: the environment, split up between its air, soil and water components, a broad category including agriculture, rural development and land use, fisheries and coastal matters, climate change, and bioenergy. The analysis of 224 policy documents, strategies and other policy-relevant documents demonstrates how Scotland has become an 'ES/NC-literate' polity through a proactive stance regarding global and European norms and requirements for nature conservation and the sustainable use of recourses. The ultimate outcome of these policies requires further analysis given the substantial implementation challenges.

1. Introduction

Despite growing awareness of humanity's dependence on nature, attempts to halt its anthropogenic degradation and destruction have so far failed to reverse global trends. The apparent inability to solve this contradiction highlights the inadequacy of development models that have allowed the pursuit of ultimately self-damaging activities, notably by overlooking or completely dismissing nature's contribution to human well-being (Schumacher, 1973: 12–13; The Economics of Ecosystems and Biodiversity, 2009: 4, 7; Gómez-Baggethun et al., 2010: 1211–1212). Fully acknowledging human-ecosystem interdependencies calls for a dilution of the somewhat artificial nature/culture divide (Latour, 2004). From an anthropocentric perspective, such an approach requires cognitive and practical tools capable of correcting the "fundamental asymmetry at the heart of [our] economic systems" between short-term decision-making and long-term stewardship of the natural environment (Guerry et al., 2015: 7348).

The concepts of ecosystem services (ES) and natural capital (NC) bridge the environment/economy gap by phrasing nature's value to society in economic terms to make it more explicit. ES are the benefits people obtain from ecosystems, usually classified along functional lines, using categories of provisioning, regulating, cultural, and supporting services (de Groot et al., 2002: 404; Millenium Ecosystem Assessment, 2003: 53–60). NC consists in the imperfectly substitutable and limited stocks of living and abiotic resources from which ES flows originate (Schumacher, loc. cit.; Wackernagel and Rees, 1997: 3–4; Millenium Ecosystem Assessment, 2003: 28–29; The Economics of Ecosystems and Biodiversity, 2010: 33). Since the publication of the Millennium Ecosystem Assessment (Millenium Ecosystem Assessment, 2003), the ES/NC framework has been included in international agreements, such as the Strategic Plan 2011–2020 adopted by UN Convention of Biological Diversity and the so-called "Aichi Targets" it has set out (UNEP/CBD/COP/11/35). International recognition has in turn led to integration of ES/NC into concrete policies across the different sectors of

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governmental action (Guerry et al., 2015: 7351–7354; Geijzendorfer et al., 2017).

The European Union (EU) assumed a leading role in promoting ES/NC as a conceptual framework with practical implications for policy-making. In 2007, the German Ministry of the Environment and the European Commission jointly initiated further research with a stronger focus on potential applications, leading to The Economics of Ecosystems and Biodiversity (The Economics of Ecosystems and Biodiversity, 2010). TEEB provided the case for a better integration of ecosystem science into economic decision making, and then formulated policy recommendations for the actual implementation of a coherent policy framework capable of addressing ES/NC (Daily et al., 2009). The EU also took a proactive stance on the "Aichi targets". Targets 14 to 16 enshrine "enhance[ing] the benefits to all from biodiversity and eco-system services" as one of five strategic goals (UNEP/CBD/COP/11/35: 103–104). The EU biodiversity strategy has adopted the 2020 deadline to "[halt] […] the degradation of ecosystem services […], and restor[e] them in so far as feasible", leading to an effort to improve knowledge of ecosystems and their services in the EU through the Mapping and Assessment of Ecosystem Services by Member States ("MAES", COM (2011) 244: 2.1, 4.1, Action 5 in Annex; Biodiversity Information System for Europe, online).

The EU's subsidiarity principle implies that European institutions cannot directly implement their statements of intent regarding ES/NC. At the European level, fleshing out an effective ES/NC policy consists in integrating these notions into frameworks for decision-making in policy sectors where the EU has some authority over Member States. As such, the overall coherence of ES/NC integration and the extent to which policy is actually implemented both need to be assessed. The term "integration" is often used to describe policy harmonisation between EU Member States (as in Jordan, 2002), and in this study it refers specifically to the effective take-up of the ES/NC framework to address environmental concerns and formulate solutions in a given policy area (cf Fisher et al., 2008). This is similar to "policy transfer" of a cognitive framework and associated ideas and norms associated (Stone, 1999; Dolowitz and Marsh, 2000: 5). Although the ultimate goal of thinking in terms of ES/NC is to have environmental considerations informing decision-making in all policy sectors, it is only one potential and partial route towards what some authors have dubbed environmental policy integration (EPI; Lafferty and Hovden, 2003). EPI is much broader than our objective, which is to focus on the ES/NC framework.

A previous review evaluating the extent to which EU policy framework demonstrates a comprehensive and effective understanding of ES/NC concepts has revealed important discrepancies between different policy areas, including several opportunities for improved integration and policy coherence (Kettunen et al., 2014). Furthermore, the translation of these EU policy directions into national and regional policies has been identified as requiring further investigation at different implementation scales. (ibid.: 11–12, 45). This paper seeks to address this research gap, by evaluating ES/NC policy integration in Scotland and comparing results with those obtained at the EU level, potentially pointing at "inappropriate" transfers (Stone, 1999: 54). Since environmental policy is a devolved matter, the analysis will reveal 'local' specificities in the way ES/NC are understood and articulated, and the extent to which Scottish policy has been influenced by European requirements and opportunities. The latter is especially interesting now that the UK has decided to leave the EU. The specific research questions addressed in this paper are therefore:

(1) How explicit and comprehensive are Scottish policy documents in their use of the ES/NC framework, to formulate issues, needs and potential solutions?
(2) How does Scottish policy echo corresponding European texts?

The analysis encompassed eight policy sectors for which the EU has clearly started promoting policies based on the ES/NC framework: the

environment, split up between its air, soil and water components, a broad category including agriculture, rural development and land use, forestry, fisheries and coastal matters, climate change, and finally bioenergy. Unsurprisingly, these policies areas relate to either conservation or economic activities deriving products directly from eco-system functions. By looking at them separately, the present analysis seeks to offer a "process-based account", in which the distinctive histories, routines and actors of individual governmental departments are expected to result in different paces and patterns of integration (Jordan, 2002: 51–61; Stone, 2004: 550–552). Policy transfer can take different guises as notions travel from one context to another and hybridise with "native" conceptions (Dolowitz and Marsh, 1996: 351). Following a description of the analytical framework we present detailed findings for the forestry sector. Findings for the seven other sectors are provided as Supplementary Material, but used to answer the research questions and draw conclusions about the uptake of the EU-promoted ES/NC framework by Scottish authorities.

2. Analytical framework

The evaluation of ES/NC integration in Scottish policy is based on a deductive qualitative content analysis of 212 policy documents, using specific criteria to identify four categories of policy integration. A purposively-selected sample of texts has been analysed using pre-established categories to make sense of its content with regards to the research question (Elo and Kyngäs, 2008: 109–112). The texts for each policy sector are listed inthe Supplementary material.

Following Kettunen et al., a first distinction is made between conceptual and operational integration. Conceptual integration exists when the ES/NC framework is used to identify and address environmental challenges and opportunities in a given policy area. Operational integration exists when dedicated policy instruments are in place to protect or restore ES/NC. Note that the significance or effectiveness of the policy instruments proposed is not considered. As an analytical concept, operational integration accounts for the articulation of policy instruments towards the specific goal of addressing issues made visible by conceptual integration.

These two aspects of ES/NC integration have then been assessed in terms of explicitness and comprehensiveness, in a continuum ranging from to 'comprehensive and explicit' to 'no specific integration' (see Table 1). As a criterion, comprehensiveness points at the extent to which a policy area has drawn on available ES/NC research. Documents can display explicit reference to the ES/NC framework, yet overlook relevant natural resources and ecosystem. Implicitness indicates a lower level of integration, where environmental protection is not presented without considering human wellbeing. In some policy sectors, texts might resort to precursor concepts such as "nature valuation", yet without necessarily allowing for the holistic vision linking NC and ecosystem functions to the full range of human benefits they underpin.

Documents were reviewed using the categorisation matrix described in Table 1. For each policy sector, a brief review of the existing ES/NC research literature was conducted to evaluate comprehensiveness – if possible using articles and reports referring to Scotland. Explicitness was assessed based primarily on lexicon. However, a context-sensitive, inductive approach was required when looking for implicit references and operational integration. For some particularities of the corpus a vocabulary of more or less loosely connected terminology to ES/NC was developed.

3. Results

The following section first presents the specific findings for Scottish forestry policy. This sector was chosen to illustrate the sectoral policy analyses because it provides a snapshot of serval dynamics at play across the different policy areas reviewed. (which are included as Supplementary Material). Subsequently, a summary overview of all

Table 1
Categorisation of the level of policy integration, adapted from Kettunen et al., 2014: 11–12.

Level of integration		Conceptual integration	Operational integration
Comprehensive and explicit	Explicit recognition of all ES, including the recognition of ES and NC as underpinning elements of human wellbeing	Explicit mention of "ES", "NC", "green infrastructure", and all the specific ES relevant to the policy sector.	Dedicated instruments comprehensively address ES/NC within the policy area.
Explicit but not comprehensive	Some explicit integration (e.g. some specific ES), including some recognition of ES and NC as underpinning elements of human wellbeing.	Some but not all of the terms are present.	Some instruments exist that proactively address/ build on the understanding of ES and natural capita within the policy area.
Implicit and incomprehensive	Implicit and indirect integration, generally focus on preventing negative impacts of a policy sector on ES and NC	"ES", "NC" or "green infrastructure" not explicitly mentioned, but precursor or related concepts are present: "ecosystem approach", "ecosystem benefits", "multi benefits", "multifunctionality", "ecosystem/nature valuation", "enhancement/ improvement of nature", or other reference to nature's contributions to human welfare.	No dedicated instruments exist for directly addressing ES and NC. Some aspects – mainly focusing on avoiding negative impacts on (some) ES – integrated into sectoral instruments.
No specific integration	No recognition (direct/indirect) of ES and NC	No recognition (direct/indirect) of ES and NC	No instruments exist that would in any way address ES and NC.

eight policy sectors is then provided along with comparison with the European analysis by Kettunen et al., 2014).

3.1. A sectoral close-up: forestry

3.1.1. Forest-related ES/NC in Scotland: opportunities and threats

Scottish woodlands contribute to human wellbeing through numerous ES, yet the ability of existing indicators to capture their value varies greatly from one to another (for an overview see Ninan and Inoue, 2013: 138). Provisioning services such as timber production or water supply are relatively easy to quantify and well documented (Aspinall et al., 2011: 897, 947–948). Yet Scottish forests also procure spiritual and recreational as well as regulating services (e.g. including climate regulation through carbon sequestration), which are difficult to quantify (Ninan and Inoue, 2013: 147). Further difficulties arise from an incomplete understanding of underpinning ecological relationships. Due to uncertainties regarding the interactions between water and nutrient cycling, soil formation, biodiversity and primary productivity, we lack sufficient data about relevant ES-supporting mechanisms.

Such an uneven understanding of forest ecosystems has led stakeholders to prioritise increasing forest cover. ES directly linked to the extent of woodlands like carbon sequestration have benefitted from this expansion, while subtler structural changes such as the fragmentation of native forests have had an adverse impact on others such as soil formation and biodiversity (Aspinall et al., 2011: 917–919). Undifferentiated forest expansion in the name of carbon capture is indeed based on total benefits rather than a marginal analysis, and therefore potential opportunity costs can arise as plantations simply cannot provide as many ES as biodiverse native woodlands (Thomas et al., 2015: 151).

The successful integration of ES/NC into forest policy implies the recognition of potential trade-offs between the different benefits society derives from woodlands, and, when applicable, the promotion of sustainable forestry practices to maximise ES provision. To implement a truly integrated forestry model, management approaches must articulate a comprehensive vision of woodland ES to support decision-making (Sing et al., 2018). Challenges to the achievement of this goal include the non-commensurability of market and non-market values and the accounting of disservices like fire hazard or invasive alien species (Patterson and Coelho, 2009).

3.1.2. Assessing forest policy: governance levels and ES/NC integration

Despite the recognition of woodland ES in official publications,

limitations in the EU's formal competencies for forestry and hence scope of action have prevented the development of a dedicated European forest policy based on binding legislative acts (Kettunen et al., 2014: 17, 28). Two Strategies have been issued by the Commission (COM(1998) 649; Council Resolution, 1999/C 56/01) and 2013 (COM(2013) 659), "set[ting] a framework for co-operation on forestry issues among member states", but ultimately Treaties do not confer prerogatives on the matter upon the Community bodies (Scottish Executive, 2006: 69). Scottish policy recognises the principles of "sustainable forest management and the multifunctional role of forests" promoted in these action plans with the active support of the Forestry Commission (FC), yet it is ostensibly designed to comply with other relevant European rules (such as agriculture and land use, environmental protection, or habitats and biodiversity; ibid.). It is the responsibility of member states to articulate these different policies and their own into coherent national frameworks adopting an integrated approach to the multiple services supplied by woodlands.

Thirty-seven policy documents directly related to forestry have been reviewed (listed in the Supplementary Material), complemented by several rural development frameworks such as the recently reviewed Land Use Strategy for Scotland. Those mostly originate from Forestry Commission Scotland (FCS), which acts as the Scottish Government's directorate on forest-related issues while remaining part of the Britain-wide Non-Departmental Public Body, the FC. Conceptual integration proves explicit and comprehensive in the most recent documents. ES/ NC are not mentioned in the main document of reference, the 2006 Forest Strategy, which is imputable to its publication date. There seems to be a "turning point" in policy around 2009, with a gradual generalisation of the framework in the documents. In terms of comprehensiveness, 'sub-sectoral' documents (e.g. The right tree in the right place, or Deer Management on the National Forest Estate) only provide a partial account related to their scope. The latest implementation strategies with a general purpose are both explicit and comprehensive (Woodland Expansion Advisory Group, 2012, The role of Scotland's National Forest Estate and strategic directions for 2013–2016). "Refreshing" the Forest Strategy is one of the main policies outlined in the 2016 Land Use Strategy (Scottish Government, 2016: 20), a framework heavily relying on the ES/NC notions, so completely comprehensive integration is expected in the coming years.

In terms of operational integration, a series of overall strategies and implementation plans articulates measures for the management of multiple ecosystem benefits. FCS manages the government-owned national forest estate (NFE) through its corporate branch, Forest

Enterprise Scotland (FES). The extent of the NFE, which covers 32.7% of Scottish woodlands (Wightman, 2012: 5), makes forestry quite distinct from other land-based industries affecting ES/NC provision in the sense that public authorities can have a significant impact on the sector through direct action on the woodlands they own. FCS-issued frameworks serve as the basis for thematic sub-sectoral plans articulating directions for the NFE with incentives towards private woodland owners and communities. Policy texts offer a proactive operationalisation of the ES/NC framework, emphasising not only on reducing damage to benefit-providing ecosystems, but indeed using their functions to maximise outputs. This reformed vision arguably built on the pre-existent, explicit understanding of forestry as the management of natural systems for the provision of goods and services. Yet gaps in the available data limit action with regards to some ES (see for instance the abandon of indicators for flood resilience in 2015). Forestry stands out as a policy sector in which ES/NC integration is relatively advanced, yet the full implementation of the explicit and comprehensive policy objectives it sets face significant practical limitations.

3.2. ES/NC integration in Scottish policy

The overall performance of the eight policy areas is summarised in Fig. 1, using the dimension and criteria derived listed in Table 1. Several sectors appear to be in a transitional state, as 'upper tier' policies are still in the process of being translated into concrete norms, projects and practices depending on policy cycles and agendas in each area. The pace at which the Scottish water environment policy integrates ES/NC for instance depends on how the River Basin Management Plans review and implementation processes are timed. In the case of soil policy, significant changes are ongoing due to the relatively recent rise of soil ecological quality as a public issue. In other cases, the subdivisions of a policy sector can display significantly dissimilar level of ES/NC framework uptake. Climate change prevention appears for instance more advanced than mitigation when it comes to take advantage of ecosystem function, as policy puts a particular emphasis on carbon capture. Such examples call for continued monitoring of these policy sectors.

The level of ES/NC policy integration is also compared to the integration levels observed in EU policy documents by Kettunen et al. (2014). In terms of conceptual integration, Scottish policy text present a deployment of the TEEB framework at least as comprehensive and explicit than European texts in most sectors, with only bioenergy and environmental policy relating to water lagging. Scotland's level of

operational integration of ES/NC goes beyond what was achieved at the EU level in most areas. The reason is that Scottish policy articulates solutions to most of the challenges and opportunities stemming from conceptual integration of ES/NC within a given sector. This is somewhat unsurprising, as operationalisation is linked to subsidiarity (i.e. expected to be further developed at the national level). But it nevertheless demonstrates that across most themes, Scottish policymakers have gone beyond EU 'minimal requirements', which range from commitment to optional provisions (soil strategy) to priority given to environmental options in funding allocation (as with rural development subsidies).

Both 'translation' delays and intra-sector imbalances reveal that despite the voluntarism of Scottish policymakers, European authorities play a leading role in promoting ES/NC thinking. The temporality of policy cycles is partly influenced by the time needed to rephrase and adapt EU guidance or requirements once issued for their implementation in Scotland. Similarly, the disparities between specific items within policy sectors mentioned above tend to mirror those found in European texts.

4. Discussion

The full analysis across the eight policy sectors (see Supplementary Material) reveal parallels between sectors. The following discussion draws on evidence gathered during the entire review summarising the general dynamics and trends of ES/NC integration in Scottish policy.

4.1. Scottish policy and European requirements: striving to become an exemplar

The assessment of conceptual integration designates Scotland as an overall 'ES/NC-literate' polity, with discrepancies between policy sectors often reflecting differences in integration at the European level. The numerous references in Scottish documents demonstrate how much the EU has had a leading role in promoting this terminology and the cognitive framework it relates to. However, several European policies that try to operationalise the ES/NC agenda have limited influence due to Member States' freedom in setting their own objectives among several possible priorities, given subsidiarity. The policy framework for rural development exemplifies this, national governments drafting their own Rural Development Plans (RDPs) along European guidelines, and then being allocated funds to implement them. Other documents such
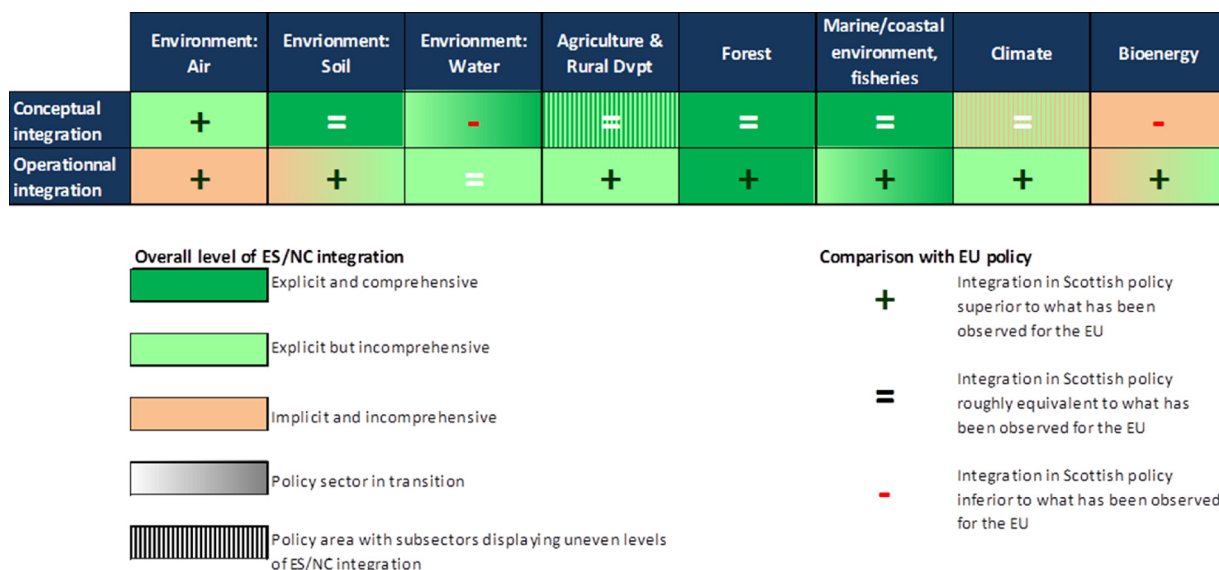
	Environment: Air	EnvIronment: Soil	Envronment: Water	Agriculture & Rural Dvpt	Forest	Marine/coastal environment, fisheries	Climate	Bioenergy
Conceptual integration	+	=	-	=	=	=	=	-
Operationnal integration	+	+	=	+	+	+	+	+

Overall level of ES/NC integration

- ▇ Explicit and comprehensive
- ▇ Explicit but incomprehensive
- ▇ Implicit and incomprehensive
- ▇ Policy sector in transition
- ▨ Policy area with subsectors displaying uneven levels of ES/NC integration

Comparison with EU policy

+ Integration in Scottish policy superior to what has been observed for the EU

= Integration in Scottish policy roughly equivalent to what has been observed for the EU

- Integration in Scottish policy inferior to what has been observed for the EU

Fig. 1. Summarised overall assessment of the conceptual and operational integration of the ES/NC framework into Scottish policy text, and an indicative comparison to EU policy.

as the Soil Thematic Strategy or the EU Forest Strategy are mostly indicative, relying on good will from the Member States to turn them into enforceable policies (Kettunen et al., 2014).

Regarding this kind of non-compulsory ES/NC-oriented provisions, Scotland has proven particularly proactive. The Scottish Rural Development Programme explicitly takes up the fourth European Agricultural Fund for Rural Development (EAFRD) priority of "restoring, preserving and enhancing ecosystems" and provides for the allocation of some Pillar 2 funding to promote sustainable forestry (Regulation (EU) No 1305/2013, Article 5; SG, 2015[2014]: 84, 248–250). Documents also testify the role of Scottish authorities in pushing UK-wide policies to go beyond minimal requirements within the framework provided by European sectoral policies (see for instance the request to refine Land Use, Land-Use Change and Forestry (LULUCF) sector emission scenarios, Thomson and Hallsworth, 2012: 2). These orientations are revealing of a policy-politics interface, as the behaviour of the Scottish Government reflects its claimed commitment to position Scotland as a pro-EU, environmentally-friendly exemplar (Scottish Government, 2014a,b, 2015a).

This stance is also reflected in overarching Scottish policies echoing directly the transversal frameworks adopted by the European authorities. The EU biodiversity strategy to 2020 has led to the publication of the 2020 Challenge for Scotland's Biodiversity in 2013 and the Route Map to 2020 in 2015. These texts update Scottish objectives in accordance with the Aichi Targets, articulate the overall vision for biodiversity with recent policy and scientific developments, and further inter-departmental coordination through the creation of new working groups. Environmental assessments constitute another type of horizontal tool potentially contributing to the integration of ES/NC into Scottish policy, since they are designed to prevent development projects to have negative impacts on the environment. The Environmental Assessment (Scotland) Act 2005 transposed the European Directive, 2001/42/EC making provision for Strategic Environmental Assessments. Here Scottish authorities once more go beyond mere compliance, opening the door to an approach in line with the ES/NC framework by demanding the assessment of projects with regards to:

"biodiversity; population; human health; fauna; flora; soil; water; air; climatic factors; material assets; cultural heritage, including architectural and archaeological heritage; landscape; and **the inter-relationship between [these] issues**" (Schedule 3, section 6, emphasis added)

However, according to some stakeholders, the EASA 2005 has not lived up to its potential, being also reduced to a "prevention and control" role (Bailey, 2010: 30–31; Scottish Environment LINK, 2011: 22).

Nevertheless, the operational integration of ES/NC is often significantly more limited than conceptual uptake despite the voluntarism of Scottish authorities. Gaps in available and accessible data and more generally in the evidence base for the design of appropriate instrument is a recurring theme in policy, including the latest Land Use Strategy (Scottish Government, 2016: 20–22). The emphasis put upon further research funding in many strategies and action plans sounds like an admission of the limits faced by environmental scientists when they try to provide decision-makers with evidence-based recommendations, as well as an indicator of the actual costs associating with the development of such 'governance knowledge'.

4.2. A distinctive policy approach to ES/NC: terminology, policy articulation and political preferences

Recurring phrases categorised as implicit references to ES/NC during the content analysis reveal the existence of a British/Scottish terminology adding to the vocabulary developed in international academic and policy. Part of these lexical differences can be explained by an 'incomplete' integration of the 'standard' ES/NC framework and by path dependency, with the persistence of equivalent phrases that pre-date the development of those related to ES such as "ecosystem

benefits", "natural assets" or "natural beauty and amenity". Despite the beneficial role of precursor notions that helped to introduce the ES/NC framework, the publication of clarification notices such as the briefing authored by Waylen and Blackstock (2015) also points towards a risk of confusion among practitioners caused by the transition to a new terminology.

Beyond lexical adjustments, framing specificities can denote a distinct policy style implying preferences for a certain way of understanding the concepts and the implementation methods associated with it. Policy through which ES/NC have been operationally integrated in Scotland revolves around strategic planning with particular attention given on consultation, public participation and shared benefits. Access policy, funding incentives, decision-support indicators, targeted research and best-practice promotion all correspond to a political will to use the ecosystem approach "as a mechanism for developing partnerships and collaborations to foster sound environmental management at local, regional and national scales" (Scottish Government, 2009a; Aspinall et al., 2011: 955). This reflects the general tendencies of Scottish governance methods (Keating, 2010: 24, 203). Conversely, Scottish authorities prove reluctant to resort to the monetary valuation of ES paired with market-based instruments compared to the governments of other Member States or European regions (see for instance Bauler and Pipart, in Jacobs et al., 2013: 124–125) as well as the rest of the UK.[a]

These preferences also transpire from the way Scottish policy relating to ES/NC has been articulated and hierarchised because of the potential trade-offs existing between ES. Scottish stakeholders and policymakers are using policy documents and position statements to present their respective visions what the overall architecture should look like (see for instance Scottish Environment LINK, 2009: 7). The climate change and land use strategies currently stand out as higher tier policies setting the objectives the other "productive" and resource management sectors must jointly contribute to (Scottish Government, 2016; Scottish Government, 2009a: 21). This precedence originates from the large-scale, overarching goals that these frameworks pursue, namely the reduction of net national GHG emissions and an overall balance in land use patterns. On the other hand, biodiversity and environmental standards seem to influence other policy areas in a more "horizontal", diffuse and somewhat passive way by homogenising practices to limit detrimental effects on ecosystems. Note that water policy, the environmental subsector that promotes the most proactive approach to ES/NC management, combines protective regulations and land use planning through River Basin Management Plans. Implementation tools and challenges are most likely to be observed as developments of the most 'hands-on' policy sectors and subsectors: river basin management, forestry, agriculture and rural development and bioenergy.

4.3. The dynamics of conceptual integration: terminological transfers and innovation

In addition to path dependency effects in the phrasing of a "national" terminology, the sequential analysis of the data highlights intra- and inter-organisational transfer dynamics. The progressive integration of the ES/NC concept and terminology is salient in the case of organisations that have published a significant volume of documents on related policy topics, making possible the establishment of an internal diffusion chronology. The numerous strategies and reports issued by FCS provide a telling example of such step-by-step assimilation. 2009–2010 stands out as the pivotal period for this organisation. Prior to this date, publications resort to 'in-house' vocabulary somewhat equivalent to the ES/NC lexical framework (see for instance the

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[a] 1 As stated by a participant to the ESCom conference, Scottish agencies are "less obsessed by monetary valuation" than their homologues from other British public bodies.

documents supporting the Woods in and Around Towns programme, which use phrases such as "forestry resource" or "woodland benefits" until 2008; Forestry Commission Scotland, 2008a: 7, 11), while most of the documents released since 2010 contain explicit and comprehensive references to ES. This inflection in the wording of FCS policy also illustrates the role of inter-organisational 'mimicry', as the transition towards ES/NC seems to have been initiated by a 2009 statement from the Scottish Government (2009b), The Scottish Government's rationale for woodland expansion.

The combination of concept diffusion between and within organisations, with their own pre-existing 'cultures', also contributes to the development of sectoral variations on the general framework. Forestry publications have for instance given birth to an extensive jargon that reflects stakes specific to this policy area and its actors, with phrases such as "productive woodlands", "sustainable forest management" or "forest restructuring".

4.4. Implementation challenges: delivery through and beyond instruments

The formulation of concrete policy measures to tackle the issue of ES/NC management in policy documents does not guarantee their full implementation 'on the ground', not to mention the delivery of the desired outcomes. The extent to which the adoption of dedicated policy instruments translates into decisions and actions corresponding to policy objectives requires observing the actors in charge of enacting the texts in practice.

The development of an integrated policy response in a context of functional and spatial governance divisions points at a consequent obstacle to delivery. ES/NC issues have implications across Scottish policy areas and at different scales, calling for coordination between multiple schemes, decision processes and competent authorities. The integration and hierarchisation of the different topical frameworks mentioned in subsection 4.2 partly addresses this challenge, but non-concordance between management scales and agencies remain because of the specificities and historical construction of each policy sector. Comparing how the different territorial divisions mentioned in the policies reviewed overlap vividly illustrates persistent coordination difficulties (Scottish Government, OnlineA; Scottish Natural Heritage, non-dated: 19). The streamlining policy and coordination initiatives launched by the Scottish Government are part of a general effort towards integrated delivery. Yet this solution has shown its limits, the cross-departmental Scottish Environment and Rural Services being replaced in 2011 by the less inclusive Scottish Government Environment and Forestry Directorate (Pack, 2013: 3–7).

Regional Land Use Strategy (LUS) pilots in Aberdeenshire and the Borders as part of the review of the Scottish LUS have led to the publication of reports on these local attempts to apply an ecosystem approach to planning (Scottish Borders Council, 2014; Davidson et al., 2015). Secondary sources like these cannot replace first-hand field investigations, but they can nevertheless provide preliminary answers as to how policies are actually implemented and offer insights about the way in which different policies and guidelines interact to shape outcomes. When asked to adopt an ecosystem approach to produce regional strategies, the two local authorities followed the 2011 Information Note on the topic, which identifies SEA as "a pragmatic means" to "make a greater use of an ecosystems approach without adding complexity to existing plan and policy making processes" (Scottish Government, 2011: 7; Scottish Borders Council, 2014: 8; Aberdeenshire Council, 2015a: 25). In doing so, the two councils were forced to use SEAs to its full strategic potential, which public bodies are usually reluctant to achieve as the process "appears to be treated often as a barrier to policy making rather than an aid" (Scottish Environment Link, 2011: 22). As a matter of fact, both faced difficulties in effectively integrating an ecosystem approach to SEAs, expressing doubts about the usefulness of this way of using SEA as an instrument and stressing the cost of developing new procedures (Scottish Borders Council, 2014:

8, 49; Aberdeenshire Council, 2015a: 25–26). The Scottish Borders Council even concluded that due to the costs of the operation and the lack of obligation mechanisms the enactment and monitoring of their pilot is unlikely (Scottish Borders Council, 2014: 47, 23). The lesson to be drawn here in terms of instrument design is that the policy mix for concretely implementing ES/NC concepts requires reflecting subsidiarity between the different actors involved, both in terms of decision structures proposed to local authorities via incentives and/or constraint, and of consequent capacity transfer and building to ensure that they are equipped to formulate end flesh out these informed decisions.

5. Conclusion

The ES/NC concepts have been promoted as a framework to integrate the contributions nature makes to human wellbeing into decision-making, complementing the intrinsic value driven rationale for environmental protection with a more anthropocentric and utilitarian approach to justify and enhance environmental protection, nature conservation and restoration. Effective uptake and implementation by policymakers at the national scale is essential for the success or failure of these concepts that are now commonly endorsed by international organisations to influence our models of development. Through its sectoral policies, the EU is actively pushing its Member States to translate notions of ES/NC into policy measures and guidelines at the national level. However, the responsibility for implementing these concepts in concrete terms remains, to a large extent, at national level.

This study assessed the integration of the ES/NC framework into Scottish policy by reviewing several sectors known for their relation to ecosystems and biodiversity. The content of the 212 texts reviewed reveals good levels of conceptual integration of the concepts but persistent difficulties in turning the patchy knowledge of ecosystem functioning into proactive policy intervention and concrete measures. The recurrent emphasis on the need for further research highlights the cost of developing reliable "information" policy instruments such as databases or monitoring frameworks. Further work on the practical administration of these plans and programmes is therefore required the fully assess these policies. The observed incentivising – or constraining in the case of formal obligations – role of European schemes and regulations due to various transfer rationales and dynamics also ask for continued scrutiny now that the UK is leaving the EU. In the wake of Brexit, it remains uncertain how British environmental policy will fare without such "European nudging".

On a methodological note, the assessment methods used here to identify policy strengths, needs and opportunities with regards to integrating the ES/NC referential require some slight modifications to consider national variations on the way ES-related issues are framed. Building on these findings and extending the analysis to other countries would not only complete the bigger picture by documenting alternative ES/NC integration patterns (for instance without the influence of any organisations comparable to the EU), but also contribute to refining the methods to achieve greater accuracy and detail in the analysis. Neither would such a widening in scope be complete without a deeper focus, and again the need for further work into local, actual implementation processes must be stressed.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the

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